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Surveillance for Asthma --- United States, 1980-1999

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Problem/Condition: Asthma, a chronic disease occurring among both children and adults, has been the focus of clinical and public health interventions during recent years. In addition, CDC has outlined a strategy to improve the timeliness and geographic specificity of asthma surveillance as part of a comprehensive public health approach to asthma surveillance.

Reporting Period Covered: This report presents national data regarding self-reported asthma prevalence, school and work days lost because of asthma, and asthma-associated activity limitations (1980--1996); asthma-associated outpatient visits, asthma-associated hospitalizations, and asthma-associated deaths (1980--1999); asthma-associated emergency department visits (1992--1999); and self-reported asthma episodes or attacks (1997--1999).

Description of Systems: CDC's National Center for Health Statistics (NCHS) conducts the National Health Interview Survey annually, which includes questions regarding asthma and asthma-related activity limitations. NCHS collects physician office-visit data in the National Ambulatory Medical Care Survey, emergency department and hospital outpatient data in the National Hospital Ambulatory Medical Care Survey, hospitalization data in the National Hospital Discharge Survey, and death data in the Mortality Component of the National Vital Statistics System.

Results: During 1980--1996, asthma prevalence increased. Annual rates of persons reporting asthma episodes or attacks, measured during 1997--1999, were lower than the previously reported asthma prevalence rates, whereas the rates of lifetime asthma, also measured during 1997--1999, were higher than the previously reported rates. Since 1980, the proportion of children and adults with asthma who report activity limitation has remained stable. Since 1995, the rate of outpatient visits and emergency department visits for asthma increased, whereas the rates of hospitalization and death decreased. Blacks continue to

have higher rates of asthma emergency department visits, hospitalizations, and deaths than do whites.

Interpretation: Since the previous report in 1998 (*CDC. Surveillance for Asthma --- United States, 196 1995. MMWR 1998;47[No. SS-1]:1--28*), changes in asthma-associated morbidity and death have been limited. Asthma remains a critical clinical and public health problem. Although data in this report indicate certain early indications of success in current asthma intervention programs (e.g., limited decreases in asthma hospitalization and death rates), the continued presence of substantial racial disparities in these asthma endpoints highlights the need for continued surveillance and targeted interventions.

Introduction

Asthma is a prevalent chronic illness in the United States that has been increasing in prevalence since 19 (1). During 1991--2001, the problem of asthma has been the focus of programs and reports from governmental agencies (e.g., the National Heart Lung and Blood Institute's National Asthma Education Prevention Program [NAEPP] [2] and the U.S. Department of Health and Human Services' Action Against Asthma report [3]) and nongovernmental commissions (e.g., the Pew Environmental Health Commission Attack Asthma report [4]). A common feature of these reports and programs is a call for improved asthma surveillance.

Asthma is a key component of the Healthy People 2010 objectives (5). Eight objectives address asthma: 1, reduce asthma deaths; 24-2, reduce hospitalizations for asthma; 24-3, reduce hospital emergency department visits for asthma; 24-4, reduce activity limitations among persons with asthma; 24-5, reduce number of school or work days missed by persons with asthma because of their asthma; 24-6, increase the proportion of persons with asthma who receive formal patient education, including information regarding community and self-help resources, as an essential part of the management of their condition; 24-7, increase the proportion of persons with asthma who receive appropriate asthma care according to the NAEPP guidelines; and 24-8, establish in >25 states a surveillance system for tracking asthma deaths, illnesses, disabilities, impact of occupational and environmental factors on asthma, access to medical care and asthma management (5).

In 1998, CDC reported on the morbidity and mortality related to asthma for 1960--1995 (1). The finding from that report included increasing trends of asthma prevalence and mortality, as well as racial and regional disparities in asthma emergency department visits, asthma hospitalizations, and asthma deaths. In addition, CDC outlined a strategy to improve the timeliness and geographic specificity of asthma surveillance as part of a comprehensive public health approach to asthma. Since the publication of the 1998 report, which included data through 1995, progress has been made in implementing this surveillance strategy.

This report presents national data regarding self-reported asthma prevalence, school and work days lost because of asthma, and asthma-associated activity limitations (1980--1996); asthma-associated outpatient visits, asthma-associated hospitalizations, and asthma-associated deaths (1980--1999); asthma-associated emergency department visits (1992--1999); and self-reported asthma episodes or attacks (1997--1999). The report also describes progress made toward developing and improving surveillance for asthma at the state and local level.

Methods

We used data from national health surveys conducted by CDC's National Center for Health Statistics (NCHS) to measure asthma prevalence, asthma episodes or attacks, asthma-associated school and work absence days, asthma-associated activity limitation, asthma physician office and hospital outpatient

department visits, asthma emergency department visits, asthma hospitalizations, and asthma deaths nationally. For the latter three measures, we determined rates in four regions of the United States,* which are geographic divisions defined by the U.S. Bureau of the Census (Figure 1). We used population estimates from the U.S. Bureau of the Census as denominators for asthma office-visit rates, asthma emergency department visits, asthma hospitalizations, and asthma deaths. We used the civilian, noninstitutionalized population of the United States as our denominator for prevalence rates and asthma episode or attack rates. We stratified each population denominator data set by region, sex, race (white, black, and other), and age group (0--4 years, 5--14 years, 15--34 years, 35--64 years, and >65 years). For determination of asthma-associated activity limitation and asthma-associated school absence or work loss we used two age strata, 5--17 years and >18 years. In this report, we list annual estimates in the tables for selected years (i.e., 1980, 1985, 1990, and 1995--1999) and annual estimates for 1980--1999 in the figure for every measure except asthma-associated activity limitation, school absence, and work loss. For those estimates, we had to group years because the denominator (i.e., persons with asthma) in the surveys was smaller.

Our results were age-adjusted to the 2000 U.S. population by using five age groups (i.e. 0--4 years, 5--14 years, 15--34 years, 35--64 years, and >65 years). Regional emergency department data and death data were age-, sex- and race-adjusted. We analyzed all data by using SAS (version 6) (6) and SUDAAN (version 7.5) (7). We used two-tailed t-tests to determine whether the differences between two points in time in asthma prevalence rates, asthma physician office-visit and hospital outpatient department rates, asthma emergency department visit rates, asthma hospitalization rates, and asthma death rates were statistically significant. We used two-tailed t-tests to compare asthma hospitalization rates and asthma emergency department visit rates between regions, racial groups, age groups, and males and females. By using the Bonferroni adjustment technique for multiple comparisons in ≤ 5 groups, we considered a familywise p-value of 0.05 as statistically significant.

Prevalence and Attacks or Episodes

NCHS conducts the National Health Interview Survey (NHIS) annually among a probability sample of civilian, noninstitutionalized population of the United States (8). Before 1997, for one-sixth of the NHIS sampled households (i.e., approximately 20,000 of 120,000 persons), participants were asked whether they had any one of 17 chronic respiratory conditions, including asthma, during the preceding 12 months. Under this design, information regarding asthma among adults might not have been reported by the subjects themselves. For children aged <18 years, a knowledgeable adult family member, usually a parent, acted as a proxy respondent. Asthma prevalence was determined if a positive response was given to the following question: "During the past 12 months, have you had asthma?"

Starting in 1997, NHIS collected information regarding asthma for a randomly selected sample child (i.e., by using a proxy respondent) in every household having a child and for a randomly selected adult in each household. Asthma attacks or episodes in the previous year were determined if positive responses were given to the following questions: "Has a doctor or other health professional ever told you that you had asthma?" and "During the past 12 months, have you had an episode of asthma or an asthma attack?" (8,9). We used SUDAAN to determine relative standard errors (RSEs) of the estimates and indicate which estimates had RSEs of <30%, indicating relatively high reliability (7).

School and Work Absence Days and Activity Limitation

Through 1996, NHIS provided data regarding days of school and work missed and activity limitations resulting from specific conditions. The number of asthma-associated school absence days in the previous weeks was collected for children aged 6--16 years during 1980--1982, and for those aged 5--17 years during 1985--1996. The number of asthma-associated work absence days for the previous 2 weeks was

collected for persons aged >17 years in 1980--1982 and >18 years for 1985--1996. Because NHIS is conducted continuously throughout the year, no seasonal bias exists in the 2-week recall period when the period information is aggregated for the entire annual sample. Survey weights were used to aggregate the number of absence days reported in the 2-week recall period during a 1-year period. We calculated the rate of absence days per person-asthma--year (i.e., person-year among all persons with asthma) and the percentage of those with asthma who had >1 absence days in the previous 2 weeks. Because of the relatively limited number of persons reporting absence days in the previous 2 weeks for each survey year, we used multiple years of data to obtain stable estimates for absence days.

Activity limitation questions measured ability to perform age-appropriate activities. The percentage of persons with asthma who reported asthma-associated activity limitation was calculated for children aged <17 years and adults aged ≥18 years who reported being currently employed. Activity limitations were classified into one of four groups: all major activity was limited; certain major activities were limited; other activities were limited; or no activities were limited. For children aged 5--17 years, major activity was defined as school attendance, and for employed adults aged ≥18 years, as working. Respondents were categorized as limited if they reported limitations in major or other activities and if asthma was identified as the primary or secondary cause of the limitation.

Physician Office Visits, Hospital Outpatient Department Visits, and Emergency Department Visits

Ambulatory medical care is the predominant means of providing health-care services in the United States. In this report, we consider both physician office visits and hospital outpatient department visits, the data for which are collected by using different surveys, as office visits; we consider emergency department visits separately. Physician office-visit data were collected through the National Ambulatory Medical Care Survey (NAMCS), which NCHS administered in 1973--1981, 1985, and annually since 1989 (10). Approximately 2,000 physicians participated each year, reporting data regarding approximately 30,000 patient encounters. Hospital outpatient department visit data and emergency department visit data were collected by using the National Hospital Ambulatory Medical Care Survey (NHAMCS), which has been administered annually since 1992 (11). Approximately 500 hospitals are sampled each year, resulting in approximately 30,000 outpatient department encounters and 30,000 emergency department encounters.

For both data sets, we identified all patient visits for which asthma (*International Classification of Diseases*, 9th Revision, code 493) (12) was the first listed diagnosis. Sample weights were used to obtain national estimates of annual outpatient (i.e., physician office and hospital outpatient department) visits and emergency department visits for asthma. We used the RSEs, which are listed with the database documentation, to determine which estimates had RSEs of <30%, indicating relatively high reliability (13).

Hospitalizations

The National Hospital Discharge Survey (NHDS), conducted annually by NCHS since 1965, is a national survey of approximately 275,000 patient records from approximately 500 nonfederal general and short-specialty hospitals. A hospitalization for asthma was defined as a primary discharge diagnosis of asthma (ICD-9 code 493) (12). Race was missing for 5%--20% of the sample in any given year (14). We excluded these persons from the race-specific rate calculations but included them in all of the other rate calculations. We used published relative standard errors (13) to indicate which estimates had RSEs of <30%, indicating relatively high reliability.

Mortality

The Mortality Component of the National Vital Statistics System includes medical conditions and

demographic characteristics reported on death certificates (15). We searched for deaths for which asthma was the underlying cause of death (ICD-9 code 493 for 1980--1998 and ICD-10 codes J45--J46 for 1999 (12,16) and calculated standard errors (i.e., the square root of the inverse of the number of deaths) because the number of asthma deaths is limited and annual rates are subject to random variation. The comparability ratio for asthma from ICD-9 to ICD-10 is 0.89, which means that 89% of the deaths classified as being caused by asthma under the ICD-9 classification would be classified as asthma deaths under the ICD-10 classification (15).

Results

Prevalence and Episodes or Attacks

The self- or proxy-reported 12-month prevalence of asthma increased 73.9% during 1980--1996, with an estimated 14.6 million persons (54.6/1,000 population) reporting asthma during the previous 12 months in 1996 (Table 1; Figure 2). Beginning in 1997, the asthma questions on NHIS changed the measures of asthma prevalence (9). Now, two measures are used, both restricted to persons with a medical diagnosis of asthma. The first is referred to as lifetime asthma prevalence, which includes those respondents with a medical diagnosis of asthma at anytime in their lives. In 1997, a total of 26.7 million persons (96.6/1,000 population) reported a physician diagnosis of asthma during their lifetime, which is substantially higher than the 12-month prevalence measured before 1997 (Figure 2). The second measure is a 12-month attack prevalence, which includes the number of persons with asthma who have had ≥ 1 attack or episode in the past 12 months. In 1997, the estimated prevalence of persons with asthma episodes or attacks was 11.1 million (40.7/1,000 population), lower than the 12-month prevalence estimated from the question wording used before 1997 (Tables 1,2; Figure 2). A sufficient number of years with the new measures do not yet exist to determine whether the trends in asthma are increasing or decreasing. Both 12-month prevalence (before 1997) and 12-month attack prevalence of asthma (since 1997) were higher among children aged 5--14 years, blacks compared with whites, and females. Neither 12-month prevalence nor episodes or attacks of asthma varied substantially among regions of the United States (data not indicated).

Absence Days and Activity Limitation

School absence days among children and work absence days among adults increased from 1980--82 to 1995--96 (Table 3). During 1980--1996, rates of school absence per child with asthma per year and the percentage of children with asthma who had limited activity because of asthma decreased slightly (4.9% and 3.7%). Also not statistically significant, the percentage of children missing ≥ 1 days of school in the previous 2 weeks decreased during the same period. Work absence days among adults with asthma demonstrated similar trends to school absence days among children with asthma, except the percentage of adults missing ≥ 1 days of work because of asthma in the previous 2 weeks increased slightly during 1995--1996, although the change was not statistically significant.

Physician Office and Hospital Outpatient Department Visits

During 1980--1999, the number of office visits for asthma as the primary diagnosis increased from 5.9 million to 10.8 million (Table 4; Figure 3). During 1992--1999, this estimate included both physician office visits and hospital outpatient department visits, with the latter category including approximately 1 million visits annually. The demographic pattern in rates of office visits for asthma demonstrated higher rates among blacks, females, and children (Table 5). Office-visit rates did not vary among regions of the country (these data not included in Table 5).

Emergency Department Visits

During 1992--1999, the number of emergency department visits for asthma increased 36%, varying by region, and the rate of emergency department visits for asthma increased 29% (Tables 6,7; Figure 4). The rates for blacks were >3 times the rates for whites, and the youngest children consistently had the highest rates (Table 7).

Hospitalizations

The hospitalization rate for asthma peaked in the mid-1980s and has gradually declined since then (Table 8,9; Figure 5). The substantial regional differences that were previously described (1) have persisted, as higher rates among blacks, women, and children.

Deaths

The number of deaths and death rates from asthma increased gradually during 1980--1995 (Tables 10,11; Figure 6). Although a determination with certainty cannot be made, data for 1996--1998 indicate that mortality rates are starting to plateau or decrease. The data from 1999 cannot be directly compared with data from previous years because of the change in the classification system from ICD-9 to ICD-10 (13). As noted in the previous report, disparities persist, with higher mortality rates documented among blacks, women, and the elderly, along with regional differences (Figure 6).

Discussion

The trend of increasing asthma-associated morbidity and mortality that occurred during 1980--1995 (1) not continued for all measures. During 1995--1998, the rate of both physician office or hospital outpatient visits and emergency department visits for asthma increased, whereas the rate of hospitalization and deaths decreased. Blacks continued to have higher rates of asthma emergency department visits, hospitalization and deaths than did whites. Although 12-month asthma prevalence increased during 1980--1996, annual rates of asthma episodes or attacks among persons with a medical diagnosis of asthma, measured during 1997--1999, are lower than the 12-month asthma prevalence determined previously. The corresponding measures of lifetime asthma prevalence, also measured during 1997--1999, were higher than the 12-month asthma prevalence.

New in this report is the estimated morbidity of asthma as determined by missed days of school and work. During 1980--1996, the number of asthma-associated work absence days and school absence days caused by asthma have increased >50%, from 6.2 to 14.0 million for work absence days and from 6.6 to 14.0 million for school absence days. This corresponds to the increase in prevalence, because the school absence days per child with asthma and the work absence days per adult with asthma have not changed during the period.

The data in this report are useful for health departments and researchers as a comparison with the morbidity and mortality attributable to asthma among the populations they study. Populations with asthma morbidity higher than the national values might require targeted intervention programs. Although these data address Healthy People 2010 goals, certain ones (e.g., objective 24-6, increase the proportion of persons with asthma who receive formal patient education, including information regarding community and self-help resources, as an essential part of the management of their condition and objective 24-7, increase the proportion of persons with asthma who receive appropriate asthma care [5], according to the NAEPP guidelines) will require different surveys.

In our previous report, we noted such limitations as a lack of data (other than death data) at the state or local level and the timeliness of these data. Although these barriers still exist, progress is being made. In 2000, the Behavioral Risk Factor Surveillance System (BRFSS), an ongoing random-digit--dialed telephone survey used in all 50 states, the District of Columbia, Guam, Puerto Rico, and the Virgin Islands added two questions regarding asthma prevalence to the core survey. These data indicate variation in prevalence among the participating sites. Lifetime asthma prevalence varied from a low of 8.0% in Louisiana to a high of 15.9% in Puerto Rico. Current asthma prevalence varied from a low of 5.0% in Louisiana to a high of 8.9% in Maine (17). In addition, local health departments have been successful in using existing data to determine patterns in asthma morbidity and, subsequently, target interventions (18

New methods are being developed for asthma surveillance, including determining incident cases of asthma by using such sites as emergency departments to capture information regarding persons with asthma and gain a better understanding of the factors related to asthma deaths (4). In 2000, CDC funded a program to implement asthma surveillance and interventions in hospital emergency departments and to evaluate the surveillance and effectiveness of these interventions in reducing subsequent asthma hospitalizations and emergency department visits. Michigan State University and the University of South Carolina have been awarded cooperative agreements for a 3-year period to work with selected hospital emergency departments serving diverse populations. A second CDC initiative begins planning for population-based surveillance of asthma incidence. Asthma surveillance sites will be population-based centers designed to assess the public health impact of asthma, to determine asthma incidence, and to identify population-based risk factors associated with asthma onset.

A third CDC initiative demonstrates the feasibility of a rapid asthma death notification system among persons aged 2--34 years. This will include investigations of the asthma-associated deaths identified and will describe the circumstances of these deaths to determine whether and how such deaths could have been prevented.

Diagnosing asthma remains challenging. Although the clinical definition of asthma is the presence of variable airflow obstruction that reverses either spontaneously or with treatment, differentiating asthma from other chronic obstructive lung diseases remains difficult, chiefly among preschool and older adult populations. Using surveys (e.g., those in this report) has additional limitations. For example, the majority of the asthma estimates contained in this report are dependent on physicians accurately diagnosing and documenting asthma in patient records, with the potential for either underestimates or overestimates of cases. Estimates of asthma prevalence, in addition, require the subjects to recall the physician's diagnosis and are subject to similar biases. The Council of State and Territorial Epidemiologists has developed a definition for asthma for use in epidemiologic studies of asthma and asthma surveillance that provides definition uniformity (19).

Asthma remains a key public health problem in the United States. This report does not indicate dramatic changes in asthma morbidity or mortality since our 1998 report (1), although the downward trend in asthma hospitalizations and asthma mortality might indicate early successes by asthma intervention programs since 1991 (2). A gradual but consistent upward trend occurred in 12-month asthma prevalence during 1980--1996; however, the major changes in question wording in 1997 make forming conclusions regarding the trend since that time impossible. Although a numeric increase has occurred in the numbers and rates of physician office or hospital outpatient department visits and emergency department visits, these increases are accounted for by the increase in prevalence. Opportunities to improve our understanding of this disease and decrease its substantial morbidity in the United States remain. Public health programs must continue to provide scientifically validated programs to improve provider and patient adherence to published guidelines for treating asthma.

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* **Northeast:** Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. **Midwest:** Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. **South:** Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. **West:** Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Table 1

TABLE 1. Estimated annual number of persons with self-reported asthma (1980--1996) or an episode of asthma or asthma attack (1997--1999) during the preceding 12 months, by race, sex, and age group, National Health Interview Survey --- United States, 1980--1999*

	1980	1985	1990	1995	1996	1997	1998	1999
	Self-reported asthma prevalence during the preceding 12 months					Episode of asthma or asthma attack during the preceding 12 months		
Race								
White	5,975,000	7,425,000	8,544,000	12,161,000	11,764,000	8,924,000	8,352,000	8,226,000
Black	899,000	1,119,000	1,413,000	2,217,000	2,310,000	1,629,000	1,680,000	1,535,000
Other	102,000†	68,000†	353,000	461,000	522,000	559,000	581,000	727,000
Sex								
Male	3,438,000	3,863,000	4,741,000	6,673,000	5,751,000	4,592,000	4,550,000	4,310,000
Female	3,538,000	4,748,000	5,570,000	8,166,000	8,845,000	6,522,000	6,083,000	6,178,000
Age group (yrs)								
0-4	369,000	661,000	840,000	1,227,000	805,000	812,000	915,000	825,000
5-14	1,530,000	1,720,000	2,270,000	3,215,000	2,771,000	2,391,000	2,321,000	2,288,000
15-34	2,251,000	2,855,000	2,898,000	4,443,000	5,139,000	3,380,000	2,853,000	3,208,000
35-64	2,056,000	2,339,000	3,220,000	4,715,000	4,441,000	3,655,000	3,598,000	3,451,000
≥65	789,000	1,036,000	1,082,000	1,238,000	1,445,000	875,000	925,000	717,000
Total‡	6,975,000	8,611,000	10,310,000	14,838,000	14,601,000	11,113,000	10,613,000	10,488,000

* All relative standard errors are <30%, unless otherwise indicated.

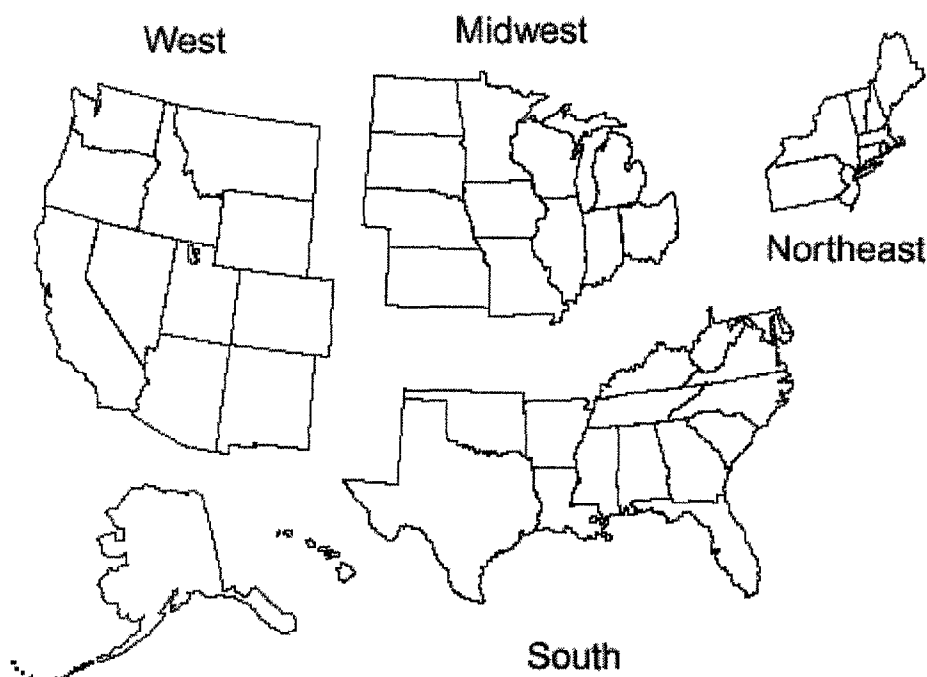
† Relative standard error of the estimate is 30%--50%; the estimate is unreliable.

‡ Numbers for each variable might not add up to total because of rounding error.

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Figure 1

FIGURE 1. Geographical regions of the United States* as used in this report



* The four U.S. geographic regions defined by the U.S. Bureau of the Census are **Northeast:** Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. **Midwest:** Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. **South:** Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. **West:** Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

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Table 2

TABLE 2. Estimated annual prevalence* of self-reported asthma (1980--1996) or an episode of asthma or asthma attack (1997--1999) during the preceding 12 months, by race, sex and age group, National Health Interview Survey — United States, 1999†

	1980	1985	1990	1995	1996	1997	1998	1999
	Self-reported asthma prevalence during the preceding 12 months					Episode of asthma or asthma attack during the preceding 12 months		
Race‡								
White	31.4	37.0	41.5	54.5	53.6	40.5	37.5	37.6
Black	33.1	38.6	45.8	64.8	65.5	45.4	46.7	42.7
Other	19.9§	12.8§	40.2	44.4	43.2	34.7	33.7	32.9
Sex‡								
Male	30.5	33.6	39.1	48.6	43.0	33.0	31.7	31.6
Female	31.9	38.9	44.2	61.1	65.5	47.9	44.4	44.5
Age group (yrs)								
0-4	23.0	36.7	44.0	60.5	40.1	41.2	46.4	42.1
5-14	45.1	50.9	63.7	82.0	69.8	60.0	57.8	56.4
15-34	30.0	36.1	37.3	57.8	67.2	44.2	37.5	42.2
35-64	29.9	30.8	38.4	50.1	46.2	37.0	35.7	33.4
≥65	31.9	38.6	36.3	39.4	45.5	27.3	26.7	22.1
Total¶	31.4	36.6	41.9	55.2	54.6	40.7	39.2	38.4

*Per 1,000 population.

† All relative standard errors are <30%, unless otherwise indicated.

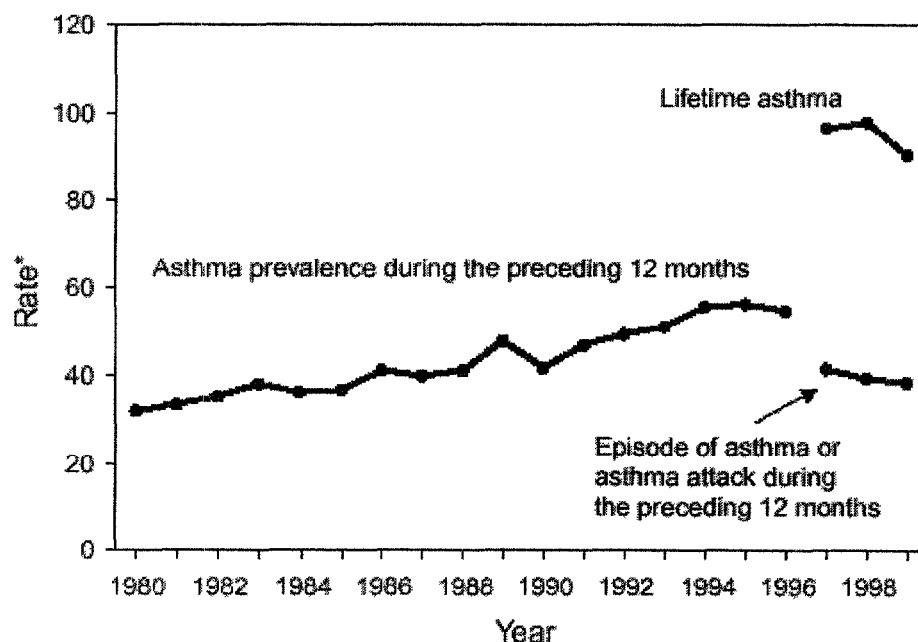
‡ Age-adjusted to 2000 U.S. population.

§ Relative standard error of the estimate is 30%–50%; the estimate is unreliable.

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Figure 2

FIGURE 2. Estimated annual prevalence* of asthma — United States, National Health Interview Survey, 1980–1999



*Per 1,000 population; age-adjusted to the 2000 U.S. population.

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Table 3

TABLE 3. Estimated average annual number of school and work absence days related to asthma, percentage with ≥ 1 absence days in the previous 2 weeks, and activity limitation caused by asthma among children aged 5–17 years and adults aged ≥ 18 years with self-reported asthma during the preceding 12 months, National Health Interview Survey — United States, 1980–1999

	1980–82*	1985–87	1990–92	1994–96
Children aged 5–17 years with proxy-reported asthma				
School absence days (millions)	6.6	11.4	14.6	14.0
School absence days per child-asthma-year	4.9	4.4	4.7	3.7
Percentage with ≥ 1 absence days in the previous 2 weeks	8.0%	8.1%	7.7%	5.4%
Percentage with activity limitation caused by asthma	27.2%	20.3%	27.6%	23.6%
Adults aged ≥ 18 years with self-reported asthma*				
Work absence days (millions)	6.2	3.8	10.7	14.5
Work absence days per adult-asthma-year	2.4	1.1	2.5	2.5
Percentage with ≥ 1 absence days in the previous 2 weeks	2.5%	2.5%	2.1%	3.3%
Percentage with activity limitation caused by asthma	14.4%	13.9%	15.7%	14.8%

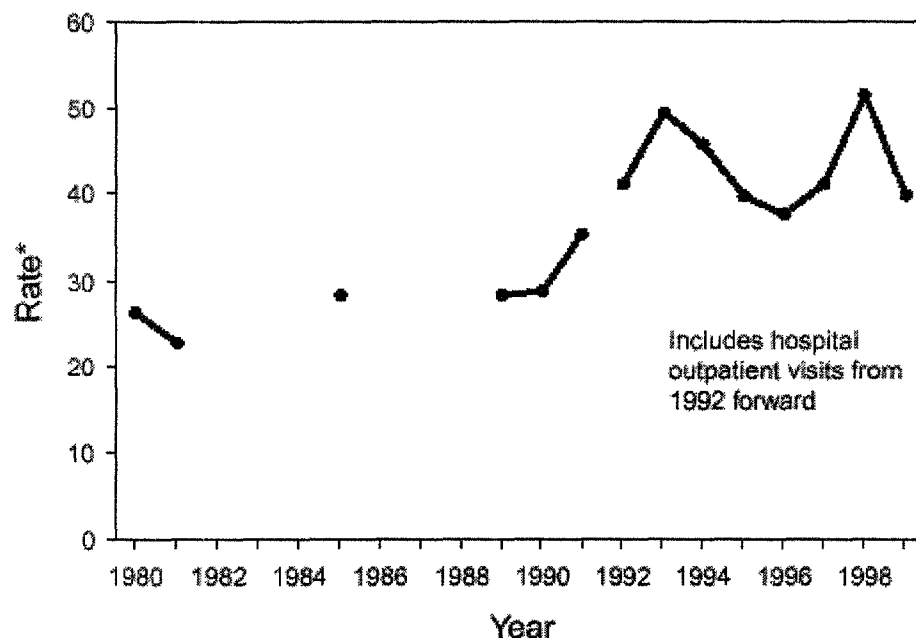
* Age groups for these years for school absence days are 6–16 years, and for work absence days, persons aged ≥ 17 years.

* Includes only adults who report being employed at the time of the survey.

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Figure 3

FIGURE 3. Estimated annual rate* of office visits for asthma as the first-listed diagnosis, National Ambulatory Medical Care — United States, 1980–1999 and National Hospital Ambulatory Medical Care Survey — United States, 1992–1999



* Per 1,000 population; age-adjusted to the 2000 U.S. population.

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Table 4

TABLE 4. Estimated annual number of physician office visits (1980--1999) and hospital outpatient department visits (1995--1999) for asthma as the first-listed diagnosis, by race, sex, and age group, National Ambulatory Medical Care Survey --- United States, 1980--1999 and National Hospital Ambulatory Medical Care Survey --- United States, 1995--1999*

	1980	1985	1990	1995	1996	1997	1998	1999
Race								
White	5,234,000	5,863,000	5,386,000	8,241,000	8,107,000	8,664,000	10,274,000	8,810,000
Black	648,000†	702,000	1,059,000	1,500,000	1,464,000	1,707,000	2,661,000	1,478,000
Other	—§	—§	692,000‡	586,000†	383,000†	559,000†	918,000	520,000
Sex								
Male	2,659,000	2,972,000	2,574,000	3,508,000	3,863,000	5,160,000	5,921,000	4,827,000
Female	3,262,000	3,532,000	4,563,000	6,820,000	6,091,000	5,770,000	7,932,000	5,981,000
Age group (yrs)								
0-4	530,000†	556,000	881,000	1,094,000	1,337,000	1,458,000	1,807,000	1,150,000
5-14	1,760,000	1,520,000	1,271,000	2,163,000	2,044,000	2,158,000	3,507,000	2,387,000
15-34	1,469,000	1,206,000	1,723,000	1,977,000	2,177,000	2,255,000	2,726,000	1,960,000
35-64	1,475,000	2,275,000	2,012,000	3,680,000	2,970,000	3,573,000	4,283,000	4,069,000
≥65	687,000	945,000	1,251,000	1,413,000	1,427,000	1,486,000	1,530,000	1,243,000
Total*	5,921,000	6,503,000	7,138,000	10,327,000	9,955,000	10,930,000	13,853,000	10,808,000

* All relative standard errors are <30%, unless otherwise indicated.

† Relative standard error of the estimate is 30%--50%; the estimate is unreliable.

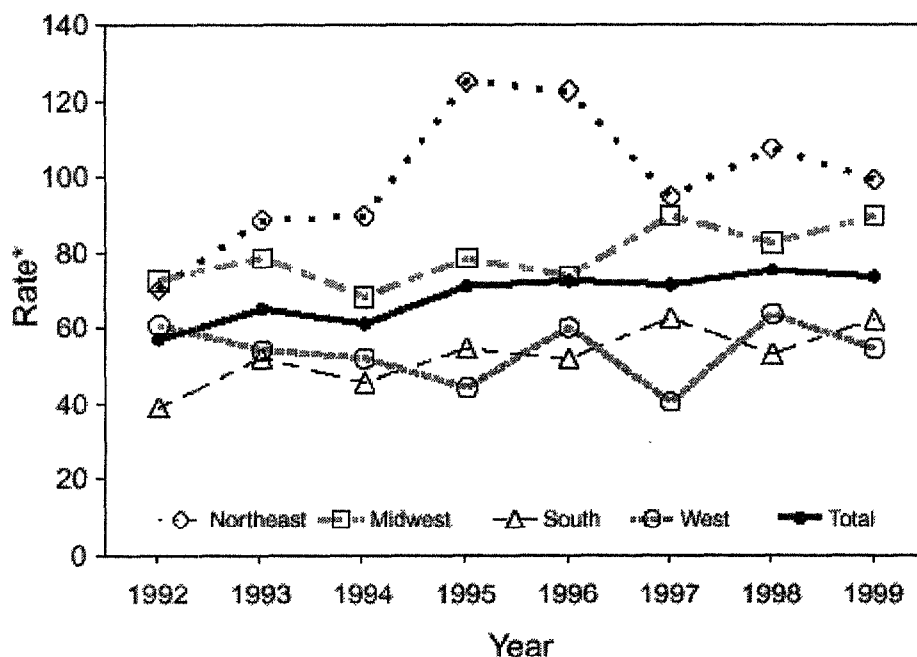
‡ Relative standard error of the estimate exceeds 50%.

§ Numbers for each variable might not add up to total because of rounding error and missing race data for 1990.

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Figure 4

FIGURE 4. Estimated annual rate* of emergency department visits for asthma as the first-listed diagnosis, by region and year, National Hospital Ambulatory Medical Care Survey --- United States, 1992--1999



* Per 10,000 population; age-adjusted to the 2000 U.S. population.

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Table 5

TABLE 5. Estimated annual rate* of physician office visits (1980--1999) and hospital outpatient department visits (1995--1999) asthma as the first-listed diagnosis, by race, sex, and age group, National Ambulatory Medical Care Survey — United States 1980--1999 and National Hospital Ambulatory Medical Care Survey — 1995--1999†

	1980	1985	1990	1995	1996	1997	1998	1999
Race‡								
White	26.9	28.8	25.8	38.3	37.2	38.5	48.6	39.6
Black	22.8†	27.8	35.6	47.2	40.0	47.7	76.4	41.9
Other	—**	—**	83.0†	57.2†	31.0†	55.1†	68.8	36.8
Sex‡								
Male	23.9	26.5	21.2	27.5	29.8	39.4	44.3	36.6
Female	27.9	29.6	35.8	51.1	45.0	42.1	57.8	43.4
Age group (yrs)								
0–4	32.4†	31.7†	47.0	58.0	70.8	77.1	95.4	60.6
5–14	50.4	43.4	36.2	57.6	53.7	56.0	90.0	60.4
15–34	18.5	15.1	21.5	25.4	28.2	29.4	35.7	25.9
35–64	21.0	29.6	24.1	38.9	30.7	36.1	42.3	39.3
≥65	26.9	33.4	40.3	43.0	42.8	44.2	45.0	36.2
Total‡	26.1	28.3	28.8	39.8	37.7	41.0	51.5	39.8

* Per 1,000 population.

† All relative standard errors are <30%, unless otherwise indicated.

‡ Age-adjusted to 2000 U.S. population.

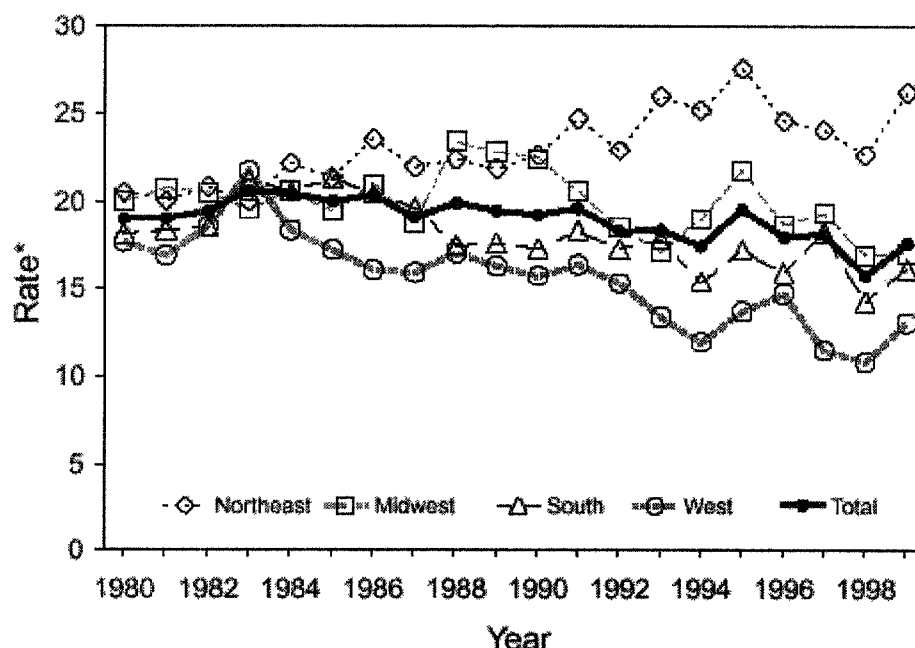
§ Relative standard error of the estimate is 30%–50%; the estimate is unreliable.

** Relative standard error of the estimate exceeds 50%.

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Figure 5

FIGURE 5. Estimated annual rate* of hospitalizations for asthma as the first-listed diagnosis, by region and year, National Hospital Discharge Survey — United States, 1980–1999



* Per 10,000 population; age-adjusted to the 2000 U.S. population.

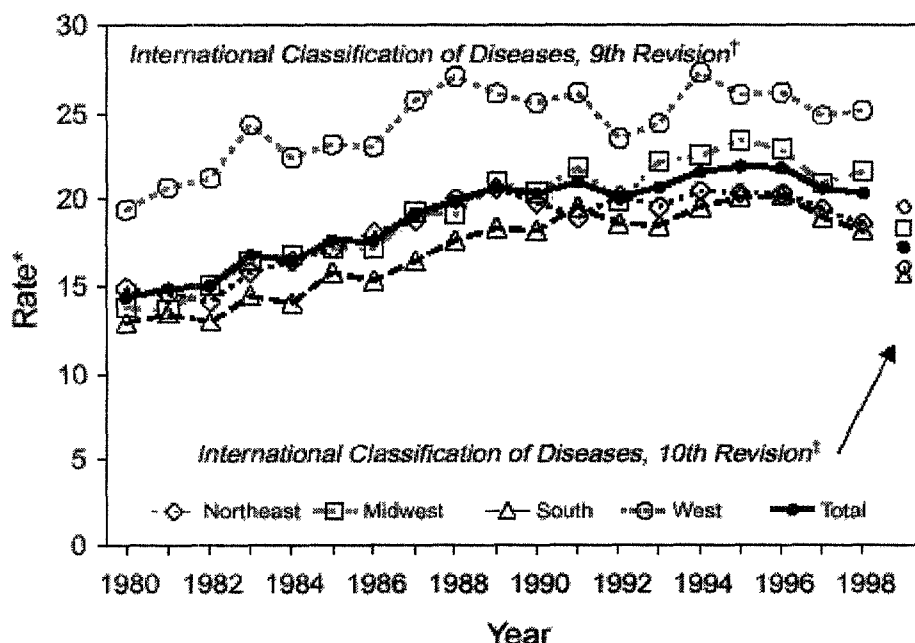
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Table 6

TABLE 6. Estimated annual number of emergency department visits for asthma as the first-listed diagnosis, by race, sex, and age group, National Hospital Ambulatory Medical Care Survey — United States, 1992–1999*

	1992	1995	1996	1997	1998	1999
Race						
White	925,000	1,018,000	1,186,000	1,263,000	1,278,000	1,313,000
Black	488,000	775,000	680,000	619,000	697,000	630,000
Other	54,000 [‡]	73,000 [‡]	69,000 [‡]	— [‡]	59,000 [‡]	54,000
Sex						
Male	667,000	725,000	968,000	809,000	908,000	932,000
Female	800,000	1,140,000	967,000	1,109,000	1,126,000	1,065,000
Age group (yrs)						
0–4	288,000	248,000	326,000	327,000	322,000	269,000
5–14	291,000	322,000	359,000	341,000	444,000	389,000
15–34	439,000	566,000	653,000	664,000	659,000	616,000
35–64	361,000	630,000	510,000	490,000	504,000	601,000
≥65	89,000	101,000	86,000	95,000	105,000	122,000
Total†	1,467,000	1,867,000	1,934,000	1,917,000	2,034,000	1,997,000

* All relative standard errors are <30% unless otherwise indicated.

[†] Relative standard error of the estimate is 30%–50%; the estimate is unreliable.[‡] Relative standard error of the estimate exceeds 50%.[§] Numbers for each variable might not add up to total because of rounding error.[Return to top.](#)**Figure 6****FIGURE 6. Annual rate* of death for asthma as the underlying cause of death, by region and year, Mortality Component of the National Vital Statistics System — United States, 1980–1999**

* Per 1,000,000 population; race-, sex-, and age-adjusted to the 2000 U.S. population.

[†] World Health Organization. Manual of the international statistical classification of diseases, injuries, and causes of death. 10th revision. Geneva, Switzerland: World Health Organization, 1999.[Return to top.](#)**Table 7**

TABLE 7. Estimated annual rate* of emergency department visits for asthma as the first-listed diagnosis, by race, sex, and age group, National Hospital Ambulatory Medical Care Survey — United States, 1992–1999†

	1992	1995	1996	1997	1998	1999
Race‡						
White	43.7	46.9	54.6	57.7	58.2	59.4
Black	143.2	226.4	188.7	171.2	183.7	174.3
Other	49.3§	56.2¶	56.2¶	—**	45.8¶	38.4
Sex§						
Male	51.7	54.4	71.9	59.5	66.7	68.6
Female	61.5	85.9	72.0	81.8	82.3	77.2
Age group (yrs)						
0–4	153.0	131.2	172.6	177.8	170.2	141.8
5–14	80.6	85.8	94.4	88.6	113.8	98.5
15–34	55.3	72.7	84.6	86.5	86.4	81.3
35–64	41.0	66.5	52.7	49.4	49.8	58.1
≥65	28.0	28.7	25.8	28.3	30.9	35.5
Total¶	56.8	70.7	72.4	71.2	75.1	73.3

* Per 10,000 population.

† All relative standard errors are <30%, unless otherwise indicated.

§ Age-adjusted to 2000 U.S. population.

¶ Relative standard error of the estimate is 30%–50%; the estimate is unreliable.

** Relative standard error of the estimate exceeds 50%.

[Return to top.](#)**Table 8****TABLE 8. Estimated annual number of hospitalizations for asthma as the first-listed diagnosis, by race, sex, and age group, National Hospital Discharge Survey — United States, 1980–1999***

	1980	1985	1990	1995	1996	1997	1998	1999
Race								
White	288,000	309,000	263,000	256,000	237,000	262,000	222,000	236,000
Black	73,000	91,000	116,000	140,000	133,000	125,000	115,000	128,0
Other	— ¹	22,000	19,000	25,000	33,000	39,000	28,000	42,0
Missing ²	42,000	40,000	78,000	90,000	71,000	58,000	58,000	72,0
Sex								
Male	180,000	195,000	191,000	210,000	195,000	204,000	188,000	190,0
Female	228,000	266,000	285,000	301,000	279,000	279,000	255,321	288,0
Age group (yrs)								
0–4	61,000	84,000	104,000	118,000	114,000	121,000	90,000	105,0
5–14	63,000	61,000	65,000	94,000	81,000	93,000	76,000	85,0
15–34	67,000	77,000	75,000	80,000	73,000	70,000	56,000	77,0
35–64	133,000	143,000	140,000	142,000	147,000	135,000	141,000	138,0
≥65	84,000	97,000	90,000	77,000	59,000	65,000	60,000	73,000
Total³	408,000	462,000	476,000	511,000	474,000	464,000	423,000	478,000

* All relative standard errors are <30%, unless otherwise indicated.

¹ Relative standard error of the estimate exceeds 50%.² Race data were not collected by certain hospitals in the survey.³ Numbers for each variable might not add up to total because of rounding error.[Return to top.](#)**Table 9**

TABLE 9. Estimated annual rate* of hospitalizations for asthma as the first-listed diagnosis, by race, sex, and age group, National Hospital Discharge Survey — United States, 1980–1999†

	1980	1985	1990	1995	1996	1997	1998	1999
Race‡								
White	15.6	15.8	12.6	11.8	10.9	11.9	10.1	10.6
Black	27.0	31.1	38.3	40.7	38.2	34.4	32.5	35.6
Other	—§	29.9	22.5	22.4	26.8	29.4	21.4	31.5
Sex‡								
Male	17.4	17.4	15.6	16.1	14.8	15.3	12.5	14.1
Female	20.3	22.2	22.1	22.4	20.6	20.4	18.4	20.6
Age group (yrs)								
0–4	37.3	47.8	55.6	62.6	60.2	63.9	47.3	55.4
5–14	18.1	17.3	18.5	25.0	21.3	24.1	19.6	21.5
15–34	8.5	9.7	9.4	10.2	9.4	9.1	7.3	10.1
35–64	18.9	18.6	15.5	15.0	15.2	13.7	13.9	13.4
≥65	32.8	34.4	33.0	23.5	17.7	19.3	17.8	21.1
Total‡	19.0	19.7	19.2	19.5	17.9	18.1	15.7	17.6

* Per 10,000 population.

† All relative standard errors are <30%, unless otherwise indicated.

‡ Age-adjusted to 2000 U.S. population.

§ Relative standard error of the estimate exceeds 50%.

[Return to top.](#)**Table 10****TABLE 10. Annual number of deaths with asthma as the underlying cause of death diagnosis, by race, sex, and age group, Underlying Cause of Death data set — United States, 1980–1999***

	1980†	1985	1990	1995	1996	1997	1998	1999‡
Race								
White	2,291	3,026	3,696	4,208	4,110	4,002	3,947	3,328
Black	567	778	986	1,247	1,325	1,200	1,290	1,145
Other	43	76	137	182	232	232	201	184
Sex								
Male	1,292	1,551	1,885	2,079	2,075	1,986	2,000	1,620
Female	1,599	2,329	2,934	3,558	3,592	3,448	3,436	3,037
Age group (yrs)								
0–4	29	27	37	34	44	35	40	32
5–14	65	100	111	151	159	130	149	144
15–34	235	338	397	522	502	472	491	444
35–64	963	1,364	1,572	1,946	1,961	1,882	1,807	1,637
≥65	1,579	2,051	2,702	2,984	3,001	2,915	2,951	2,400
Total‡	2,891	3,880	4,819	5,637	5,667	5,434	5,436	4,657

* All relative standard errors are <30%.

† Code 493 from World Health Organization. Manual of the international statistical classification of diseases, injuries, and causes of death. 9th revision. Geneva, Switzerland: World Health Organization, 1977.

‡ Codes J45–J46 from World Health Organization. Manual of the international statistical classification of diseases, injuries, and causes of death. revision. Geneva, Switzerland: World Health Organization, 1999.

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TABLE 11. Annual rate* of deaths with asthma as the underlying cause of death diagnosis, by race, sex, and age group, Underlying Cause of Death data set --- United States, 1980--1999†

	1980‡	1985	1990	1995	1996	1997	1998	1999§
Race**								
White	12.9	15.6	17.5	18.6	18.1	17.4	17.0	14.2
Black	27.6	34.8	40.9	46.2	48.0	42.5	44.7	38.7
Other	13.5	16.9	23.6	23.3	27.6	26.6	22.7	20.4
Sex**								
Male	14.7	15.9	17.8	17.9	17.7	16.6	16.5	13.1
Female	14.4	19.2	22.1	25.1	25.0	23.7	23.3	20.4
Age group (yrs)								
0-4	1.8	1.5	2.0	1.8	2.3	1.9	2.1	1.7
5-14	1.9	2.9	3.2	4.0	4.6	3.4	3.6	3.6
15-34	3.0	4.2	5.0	6.7	6.5	6.1	6.4	5.9
35-64	14.0	17.7	18.8	20.6	20.3	19.0	17.8	15.8
≥65	61.8	72.5	87.0	90.6	90.3	86.7	86.9	68.9
Total**	14.4	17.7	20.2	21.9	21.8	20.6	20.3	17.2

* Per 1,000,000 population.

† All relative standard errors are <30%.

§ Code 493 from World Health Organization. Manual of the international statistical classification of diseases, injuries, and causes of death, 9th revision. Geneva, Switzerland: World Health Organization, 1977.

‡ Codes J45-J46 from World Health Organization. Manual of the international statistical classification of diseases, injuries, and causes of death, revision. Geneva, Switzerland: World Health Organization, 1999.

** Age-adjusted to the 2000 U.S. population.

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